

THE *PSORALEA PATENS* COMPLEX

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(Accepted for publication 8.4.1980)

ABSTRACT

Lee, Alma T. (National Herbarium of New South Wales, Royal Botanic Gardens, Sydney, Australia 2000) 1980. The *Psoralea patens* complex. *Telopea* 2 (1): 129-141, figs 1-3.—Collections from all mainland States of Australia (perhaps not fully representative of Western Australia and South Australia) under the names *P. patens* Lindl., *P. australasica* Schltdl., *P. eriantha* Benth., *P. dietrichiae* Domin, *P. discolor* Domin and *P. pallida* N.T. Burb., are reviewed and types examined. The identity of the Holotype of *P. patens* (oldest name) is established. A classification is proposed, recognizing *P. patens* (incorporating *P. eriantha* and *P. discolor*), *P. australasica* (incorporating *P. dietrichiae*), and *P. pallida*, as heterogeneous species. Distribution maps are provided.

The description of *Psoralea pallida*, published on p. 127 of this issue, has been taken from an uncompleted manuscript revision of *Psoralea* in Australia, prepared c. 1955 by the late Dr Nancy Burbidge and treating, inter alia, the closest relatives of *P. pallida* already described as *P. patens* Lindl., *P. australasica* Schltdl., *P. eriantha* Benth., *P. dietrichiae* Domin and *P. discolor* Domin. In this manuscript, previously accepted taxonomy and nomenclature had been followed, viz. *P. patens* and *P. australasica* were assumed to be conspecific (thus *P. patens* by priority), and *P. eriantha* was regarded as another, prostrate, species (*P. dietrichiae* and *P. discolor* were of uncertain status). Burbidge had not seen the Type of the oldest name, *P. patens*, and its description was ineffective for typification. Being fully aware of the nomenclatural options dependent on this typification, she suggested specifically that I should investigate it.

Burbidge was perhaps not fully aware of the extent of the morphological complexity in the group, and increased collections have further blurred the distinctions between previously recognized taxa; also results of plant-breeding work in Queensland were not available at that time. Thus she thought four species could be distinguished (*P. patens*, *P. eriantha*, *P. australasica* and *P. pallida*), but also knew that 'if the erect forms [*P. australasica*] are removed, the prostrate forms [*P. patens*, *P. eriantha*] are very difficult to separate'. My own conclusion has been that these last two taxa *cannot* be separated, and that the Type of *P. patens* falls among the prostrate forms and must not be associated with the erect *P. australasica*.

To comply with Burbidge's wish that I should bring appropriate parts of her manuscript to early publication, it was necessary to investigate the whole complex of plants associated with the above names. Problems emerged both in delimitation of taxa, and in nomenclature, as follows:—

(i) The taxa

Much of the complexity of form is found in Queensland, but the Western Australian part of the complex is perhaps not yet sufficiently known, and further variation may be found in the northwest of South Australia and adjacent areas.

Three major taxa can be recognized, though they lack clear-cut genetic barriers. They are not geographic races in the usual sense of that term, though much of the morphological variation is correlated with soil type. It seems that they constitute a single gene-pool, showing adaptive differentiation into forms that are established over wide areas, maintaining themselves without much change because inbreeding by self-fertilization is general, though not obligate. Outbreeding does occur in nature, and thus the whole population of the complex at any time contains the results of "hybridizations", most of which do not succeed in the current selection regimes and eventually disappear. Even the successful results of this process make up a very

heterogeneous assemblage, but taxa can be recognized, and for simplicity of nomenclature they are treated here as species. The breeding behaviour outlined is the subject of experiment at Queensland University (I. de Lacy pers. comm. 1979). One experiment records segregation for growth-habit from which it is deduced that—

(a) the prostrate habit is dominant when prostrate plants are crossed with non-prostrate members of the complex;

(b) this prostrateness is controlled by a simple genetic system: two pairs of alleles which are complementary in action;

(c) variation in erectness is also genetically controlled but by a more complex polygenic system.

(a) and (b) are consistent with the separation of a prostrate taxon (*P. patens*) from the rest of the complex and explain the rare occurrence of an erect plant in that species; (c) is consistent with the inclusion of various degrees or forms of erect habit in another taxon (*P. australasica*).

(ii) Nomenclature

I was able to examine the Holotype of *P. patens* in the Lindley herbarium at CGE in 1974. It consists of a shoot apex with a few leaves and inflorescences, so mounted on the sheet as to suggest erect growth, and the prostrate habit of its taxon is obscured. An Isotype at K, however, shows a longer, apparently weak stem, as indicated in the protologue. Flower and inflorescence characters shown by the Type are also not fully representative of its taxon; the inflorescences are narrower (due to smaller flowers) and more interrupted* than is usual. These characters, though matched in some specimens of *P. australasica* can equally be found in *P. eriantha*, a similar "species" described later but better known, and with a prostrate habit (*P. australasica* has erect or semi-erect stems).

It thus appears that, due to characters of the Holotype and its presentation, and to deficiencies in the protologue, the name *P. patens* has been misapplied to the taxon *P. australasica*, so that the inappropriate epithet *patens* has been applied to an essentially erect and often tall plant ("eine hohe Staube" in the protologue of *P. australasica*). After gaining some familiarity with widespread representatives of these populations, I am convinced that the Holotype of *P. patens* falls within a prostrate species which includes *P. eriantha* as an inseparable and major part, and that *P. australasica* can be treated as a distinct species. Burbidge had clarified the character of *P. australasica* from type material in MEL, and knew that my conclusion was one of the nomenclatural options.

The name *P. pallida* N. T. Burb. is now available for the third species, long-recognized but hitherto unnamed, which is included in the taxonomic treatment below.

PROPOSED CLASSIFICATION

The total population of this widespread and often locally common complex may be characterized as follows:

Soft-wooded shrubby plants, fully prostrate with several to many stems radiating from a central tap root, through "semi-erect" forms with few to numerous uncertainly or weakly erect stems, to fully erect plants (short or tall) branched along one or more

* Term used to indicate considerable and often somewhat unequal spacing between the triads of flowers, but essentially relative: wide spacing of small flowers appears more interrupted, especially when some have fallen and when flowers open in slow succession. A 'continuous' inflorescence has flowers crowded, or regularly spaced as when the flowers open in quick succession.

main stems. *Stems* usually densely clothed with softly spreading or downturned hairs together with fewer, longer, spreading, hairs obscuring the glands until thinned with age, but very rarely quite glabrous and then the glands conspicuous. *Leaves* pinnately trifoliate, on petioles of very variable length, the leaflets basically ovate to truncate with variations in width, obtuse to truncate with a point at the apex, the margins apiculate-denticulate or sometimes repand-denticulate, but often entire at the base near the petiole; lateral leaflets slightly asymmetrical; surfaces glabrous to densely pubescent (the abaxial side usually more hairy) with loosely appressed to spreading hairs, the glands correspondingly conspicuous or obscured and varying in size, the veins, especially on lower surfaces, more conspicuously pubescent than the rest. *Inflorescences* axillary, racemes of almost sessile flowers in groups (usually of three) subtended by an ovate or narrower bract. *Peduncles* very short to long (less than 1 to more than 20 cm long), not always proportional to length of rachis. *Flowers* rather small, (4-) 6-9 (-11) mm long, with a densely pubescent calyx, the hairs black, grey, brown, white or mixed, and a pink, purple or bluish corolla scarcely to slightly (by up to 3 mm) exceeding the calyx. *Calyces* with lobes nearly level at the apex (i.e. nearly equal), to unequal, with the lowest lobe the longest and up to 2.5 times the length of the tube and clearly exceeding the lateral (shortest), and the upper (shorter) pairs. *Pod* $\pm$ enclosed in the calyx, silky-pilose, at least in part.

The following Key, and the Table of characters, distinguish the three species recognized here by the characters most commonly present in each. Variations from that "core" of characters are described under the appropriate species.

KEY TO THE SPECIES

(for fully typical specimens)

1. Stems erect. Aspect green. Inflorescence interrupted, the rachis and peduncle more or less equal, each often 7-10 cm long. Plants of heavy soils *P. australasica* 1.
- 1.* Stems prostrate, or ascending and finally decumbent. Inflorescence continuous. Plants of sandy soils.
 2. Stems prostrate or rarely erect. Aspect green (or grey-green in a Central Australian variant). Rachis of the inflorescence often 2-3.5 cm, sometimes almost capitate, usually shorter than the peduncle. Often in sandy creek beds or banks *P. patens* 2.
 - 2.* Stems ascending, then decumbent. Aspect grey to white. Rachis of the inflorescence often 4-8 cm, usually longer than the peduncle. Commonly on sand dunes *P. pallida* 3.

1. *P. australasica* Schldl., Linnaea 20: 668 No. 197 [misprint for 196] (1847); F. Mueller, Fragm. 3: 45 (1862) indicating synonymy with *P. patens*; N. T. Burbidge MS., in synonymy of *P. patens*, and in a note on the isotype in MEL. ISOTYPE: 196 *P. australasica* leg. Dr. Behr, mis. v. Schlechtendal (MEL 89796 !); cited as "near Bethany [c. 5 km NE. of Adelaide, South Australia] mostly near water. Dec."

P. dietrichiae Domin, Biblioth. Bot. 22 (89²): 739 (1925). ISOTYPE: Rockhampton [Queensland-Port Curtis], Dietrich 697, ii.1866 (NSW !).

[*P. patens* sensu auct., non Lindl.: Benth., Fl. Austral. 2: 192 (1864); Tate, Handb. Fl. Extratrop. South Australia: 69 (1890); Moore & Betche, Handb. Fl. New South Wales: 146 (1893); F.M. Bailey, Queensland Fl. 2: 382 (1900); ? Ewart & Davies, Fl. Northern Territory: 144 (1917)—concept appears confused; Ewart, Fl. Victoria: 668 (1931); Black, Fl. South Australia edn 2: 463 (1948); Beard, Descr. Cat. West Austral. Pl.: 71 (1965); Willis, Handb. Pl. Victoria 2: 301 (1973). Although some element of the true *P. patens* may have been included in the concept expressed under that name in these publications, the greater part of their data is referable to *P. australasica*. Following Mueller l.c., the authors did not distinguish between these two species.]

Diagnostic characters as given in the Key and Table. *P. australasica* encompasses great variation in most of its characters, and trends are observed in

TABLE 1

Comparison of characters in *P. australasica*, *P. patens* and *P. pallida*
(see also figs 2, 3, 5)

<i>P. australasica</i>	<i>P. patens</i>	<i>P. pallida</i>
Habit Erect or semi-erect, short (c. 0.5 m) to tall (-2.5 m)	Prostrate (rarely erect; erect height not recorded)	Ascending, finally decumbent; often c. 0.6 m high
Inflorescence Interrupted Long, on a long peduncle, much exceeding the leaf Rachis (5-) 7-10 (-23) cm Peduncle (3-) 7-16 (-23) cm Diam. (6-) 10-15 (-18) mm [Rachis $\pm$ equal to peduncle]	Continuous, usually compact Very short, sometimes almost sessile, to longer, often on a long peduncle (1-) 2-3 (-9) cm (1-) 2-7 (-14) cm 12 (-19) mm [Rachis usually < peduncle but the reverse in atypical form]	Continuous, often with some spacing of flowers Of medium length but exceed- ing the leaves (3.5-) 4-8 (-15) cm long (1-) 2-5 (-13) cm long (13-) 15-19 (-21) mm [Rachis usually > peduncle]
Aspect Green	Green (or greyish in atypical forms)	Grey to whitish
Leaflets Glabrous to sparsely hairy above, usually pubescent below at least on veins Terminal leaflet (1.5-) 2.5-4 (-7.5) cm x (0.5-) 1.5-2 (-4) cm	Glabrous or hoary above, usual- ly more pubescent below ($\pm$ tomentose in atypical forms) (1-) 2-3 (-4) cm x (0.7-) 1-1.5 (-2) cm	Densely grey- to white- tomen- tose on both sides (1.5-) 2-4 (-6.5) cm long x (1-) 1.5-3 (-4) cm broad
Flower (4-) 6-7 (-8) mm Corolla clearly > calyx (by c. 2 mm)	6-7 (-8) mm Corolla slightly > calyx (by c. 1 mm)	(7-) 8-9 (-11) mm long Corolla = or scarcely > calyx
Calyx Short, obconical, to open in fruit (more tubular, closed in fruit in longer forms) Tube (1.5-) 2 (-3) mm Lateral teeth (2.5-) 3-4 (-5) mm Lowest tooth (3-) 4 (-6.5) mm Hairs black, brown, grey, white or mixed, thinning with age.	Medium in length, $\pm$ tubular, not open in fruit (1.5-) 2-3 (-4) mm (3-) 4-5 (-6) mm (3-) 5-6 (-7) mm Hairs white or pale, always dense	Long, tubular, not open in fruit 3-4 (-5) mm long (4-) 5-6 (-8) mm long (5-) 6-7 (-11) mm long Hairs always white and dense
Habitat Heavy soils	Sandy soils	Sands, often on dunes

pubescence (from mostly dark hairs in southeastern South Australia to pale or white hairs in northern parts of the range) and in flower size (generally increasing from south to north). Accommodated here are some tall plants, mostly from the Port Curtis district of Queensland, but erratically elsewhere, with atypical calyx form (the teeth unequal as in *P. patens* and *P. pallida*); these may also have larger leaflets with more pubescent upper surface, and one such was differentiated as *P. dietrichiae* Domin. Fig. 2.

Forms designated below as "atypical" display greater differences than those embraced above. Such forms are all cited and mapped with the same symbols, although they are atypical in different ways. The most common variation is in habit: stems may be single, but usually few to many, and of greatly varying heights. The Queensland University breeding experiments indicate genetic control of this variation, so that habit-variants "breed true" (I. de Laey, pers. comm., cf. p. 130), and one variant which is many-stemmed has assumed significance in those experiments because of its economic potential. It has, perhaps unfortunately, been termed "semi-erect", but this term is not to be taken as indicating a heterozygous condition between prostrate and erect, but simply a particular variation from the tall, erect, typical form. However, a similar appearance at least is produced by grazing of tall, erect plants at an early stage, which merely delays the typical tall growth and induces formation of extra stems from the crown (J. Maconochie, pers. comm., from observations in Central Australia). In practice, many herbarium specimens do not allow certain evaluation of the habit represented, so that some of the citations as typical or atypical in this regard, are arbitrary. Even when an atypical "semi-erect" form is clearly indicated by specimen or label, it cannot be assumed that it will reproduce its own kind in different circumstances, though it appears that in Queensland many representatives of *P. australasica* are atypical in habit and, at the same time, true-breeding.

In a few localities in central Queensland (Warrego-Gregory South) a peculiar form appears: the leaflets have a narrow-elliptical outline with fewer and less apiculate denticulations. These plants have the erect stem and the inflorescence of *P. australasica*, but all have closely appressed, straight, ascending hairs on the stems. Such hairs are not seen elsewhere in the *P. patens* complex, but are characteristic of *P. cinerea*, a related but apparently quite distinct species which has nevertheless been confused with it in the past.

Three specimens from in or near the Musgrave Ranges (South Australia) present an atypical appearance: they have virtually no stem- or leaf-pubesence, so that prominent black glands are exposed. The calyx hairs are also very dark. This seems to be the form mentioned informally in the Burbidge manuscript as *P. australasica* "centralis", but in her treatment it is cited under *P. leucantha* and hybridism with the *P. patens* group is suspected. I have not been able to investigate further.

Finally there are a few specimens with floral and some inflorescence characters of *P. pallida*, or of *P. patens*, but with the vegetative characters of *P. australasica*, especially its habit—the flowers are long, with densely hairy calyx showing a long lowest lobe, the more or less continuous inflorescences of considerable length and with regularly spaced flowers; leaflets are glabrous or sparsely hairy above, and stems are erect or semi-erect. These cannot be unequivocally determined; they are mapped as 'X' (Fig. 1) and cited here: QUEENSLAND—Gregory North†: "Ardmore", 25 miles [40 km] W. of Dajarra, *Everist* 3203, 11.1947 (BRI); "Carandotta" Station, *Everist & Smith* 161, 2.1937 (BRI).—Leichhardt: roadside, Alpha-Emerald road, Drummond Ra., *Bisset* 2, 4.1957 (BRI). See also *P. pallida*.

† Subdivisions of the Australian States, used in citation of specimens, are derived from the following sources:—*Queensland*: Queensland Pastoral Districts, in McLean, R (ed.) 1886. 'The New Atlas of Australia . . .' (J. Sands: Sydney). *New South Wales*: map in Contr. New South Wales Natl. Herb. Fl. Ser. 1-8: 16 (1961). *Victoria*: grid system of Churchill, D. M. and A. de Corona, 1972. 'The Distribution of Victorian Plants . . .' (Roy. Bot. Gard. & Natl. Herb. Victoria and Bot. Dept. Monash Univ.: Carlton, Victoria). *South Australia*: map inside back cover, *J. Adelaide Bot. Gard.* 1 (1), (1976) and subsequent issues. *Western Australia*: map by Beard, J. S., 1978 in J. Gentilli (ed.). 'Western Landscapes'. (Univ. of Western Australia Press: Perth). *Northern Territory*: map in Chippendale, G. M., 1971. 'Check list of Northern Territory Plants'. *Proc. Linn. Soc. New South Wales* 96: 209 (1971).

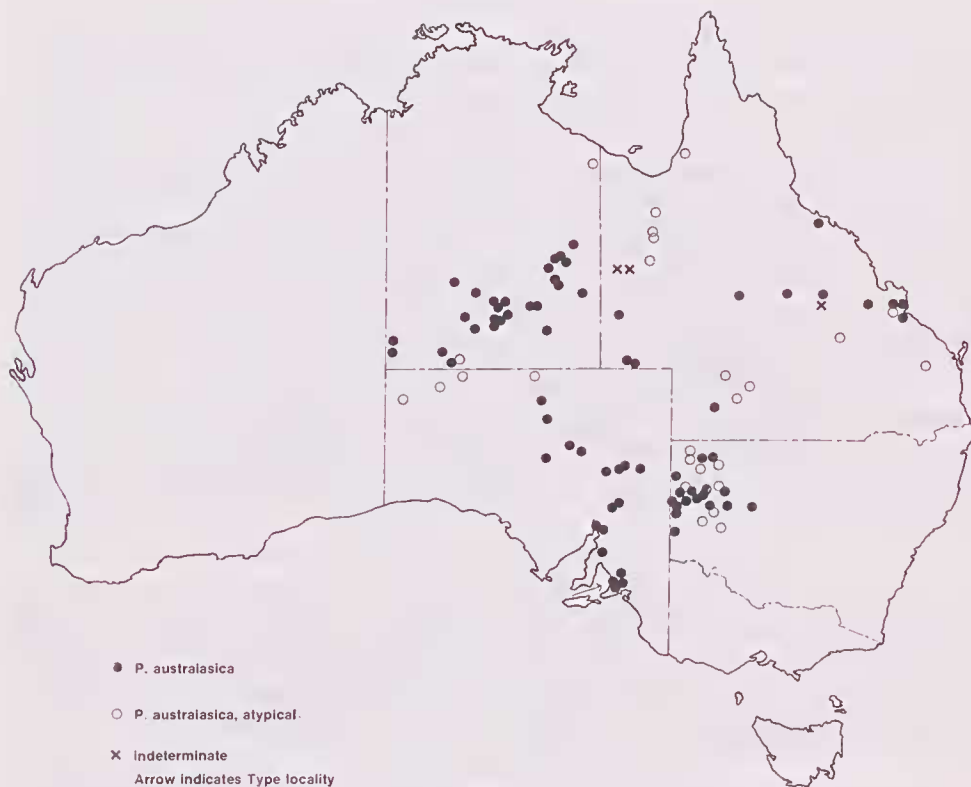


Fig. 1. Distribution of *P. australasica*.

DISTRIBUTION (see fig. 1): Queensland: Central Districts, reaching the coast near Rockhampton, and western Districts (with many occurrences atypical); far-western New South Wales (with many occurrences of "semi-crec plants"); South Australia from the coast near Adelaide (mostly typical forms) to the Northern Territory: Central Australia (mostly typical, with rare atypical forms in that Division and near the Gulf of Carpentaria). Characteristically on heavy soils (or in Central Australia on the more alkaline soils), or in depressions; rarely on sandy soils but probably only when these overlie silts.

SPECIMENS EXAMINED (* indicates atypical form): **QUEENSLAND:** Burke: Gilbert R., *White 1339*, 2.1922 (BRI, NSW)*; Flinders R., *Plant 288*, 7.1891 (BRI)*; "Granada", *Bisset, Marriott & Sillar* 6.1957 (BRI)*, *do.*, 60 miles [97 km] NE. of Cloncurry, *Everist E 250*, 9.1962 (BRI)*; approx. 55 miles [88 km] SE. of Mt Isa, *Ollerenshaw PO 1247 & Kratzing*, 7.1974 (BRI)*. North Kennedy: Ayr, *Michael 1513* (BRI). Gregory North: Mulligan R., W. Queensland, *Clarke NSW 30677*, 2.1904 (NSW). Mitchell: 45 km E. of Aramac, *Beeston 140C*, 7.1975 (BRI); 30 miles [48 km] NNW. of Longreach, *Davidson 262*, 8.1952 (BRI). Leichhardt: Clermont, *White 3458*, 3.1927 (BRI); "Springwood" 20 miles [32 km] SW. of Rolleston, *Bisset E 209*, 12.1958 (BRI)*. Port Curtis: Wowan, Callide Valley, *Langford* 11.1972 (BRI); W. of Ridge-lands . . . 5-6 miles [c. 9 km] S. of Fitzroy R., *Speck 1805*, 10.1963 (BRI, NSW); Rockhampton, *Dietrich 697*, 2.1866 (NSW); 1/4 mile [0.4 km] from Kabra Siding . . . , *Bisset E 262*, 10.1959 (BRI)*; Keppel Bay, *Thozet NSW 30676* (NSW). Burnett: Brian Pastures, Gayndah, on lower slopes of Mt. Dube, *Schoneveld 131*, 8.1959 (BRI)*. Gregory South: "Yeppera" c. 50 miles [80 km] SSE. of Windorah, *Everist 7467*, 8.1963 (BRI)*; Birdsville, *Breen NSW 117277*, 7.1974 (NSW); 15 miles [24 km] S. of Birdsville, *Boylard 202*, 9.1966 (BRI); "Nockatunga", *Dorman NSW 117278*, 9.1967 (NSW). Warrego: "Lochabie", Quilpie, *Saunders* 11.1939 (BRI)*; 88 km SW. of Quilpie, *Silcock 428*, 7.1974 (BRI)*.

NEW SOUTH WALES: North Far Western Plains: 5-mile Bore, c. 19 km NW. of Milparinka, *Lee 244*, 9.1971 (NSW)*; 123 km W. of Wanaaring on Milparinka road, *Blaxell 616*, 11.1971 (NSW); Mt. Browne, *Corbett NSW 30669*, 9.1898 (NSW)*; "Coally" near Milparinka, *Richley*

1273, 10.1973 (NSW); "Yancannia" Station, *Martensz CSIRO Div. Wildl. Res. 4120*, 12.1968 (NSW)*; 1 mile [1.6 km] S. of Palgamurtie Ck, on road to White Cliffs, *Lee 259*, 9.1971 (NSW)*; near Koonenberry Mtn (30° 31' S, 142° 18' E) . . . , *Lee 265*, 9.1971 (NSW); 5 km SE. of "Teilla" homestead, 30° 33' S, 141° 15' E, *Lee 207*, 9.1971 (NSW); "Tarella", Wilcannia-White Cliffs, *Quinn & Co. NSW 30658*, 10.1907 (NSW)*; Fowlers Gap [with various locality details], *Jacobs 2132*, 10.1975 (NSW)*, *Cunningham & Milthorpe 1027*, 9.1973 (NSW), *1368*, 8.1973 (NSW), *Thompson NSW 117276*, 7.1973 (NSW); Rock Hole Motel site . . . , 110 km NE. of Broken Hill, 31° 13' S, 142° 17' E, *Lee 266*, 9.1971 (NSW); "Rowena" Station c. 70 miles [c. 110 km] NE. of Broken Hill, *De Nardi 304*, 5.1969 (NSW); 68 km N. of Wilcannia on White Cliffs road, *Cunningham & Milthorpe 2954*, 10.1974 (NSW); 60 miles [100 km] S. from Wilcannia towards Cobar, *Martensz 67/117*, 4.1967 (NSW); 30 miles [48 km] W. of Wilcannia on Barrier Highway, *Newman 69*, 7.1962 (NSW); 36 miles [58 km] W. of Wilcannia, *Hobsan NSW 30662*, 9.1949 (NSW)*; "Churinga", Broken Hill, *Milthorpe & Cunningham 1925*, 3.1974 (NSW); Black Bluff near Broken Hill, *Morris 661*, 8.1921 (NSW, BRI); Broken Hill, per *Farmers & Settlers Newspaper NSW 30657*, 30661, 6.1934 (NSW), *Cane NSW 30660*, 6.1904 (NSW), *Morris 153*, 2.1920 (NSW, BRI). South Far Western Plains; Menindee, *Milthorpe 180*, 3.1973 (NSW)*; Boolaboolka Lake, 32° 35' S, 143° 05' E, *Milthorpe & Cunningham 2674*, 7.1974 (Soil Conservation Service, Condobolin)*; Harry Harry Ck, "Buckalow" Station, c. 62 miles [c. 100 km] SW. of Broken Hill, *Constable NSW 38481*, 7.1955 (NSW).

SOUTH AUSTRALIA: North-western Region: Alaka [waterhole; vicinity of "Ernabella"], *Turvey NSW 86924*, 8.1968 (NSW)*; Mt Harriet, *Eichler 17266*, 9.1963 (NSW)*; Camp 22, Elder Exploring Expedition [c. 27° 00' S, 129° 30' E], *Helms NSW 30681*, 30689, 7.1891 (NSW)*. Lake Eyre Basin: Xmas Bore S. of "Mt Dare" Station homestead, *Symon 3318*, 2.1965 (CANB)*; desert country towards Oodnadatta, *Fitzgerald NSW 30673*, 10.1920 (NSW); Edwards Creek railway siding, SSE. of Oodnadatta, *Briggs 1291*, 8.1967 (NSW); Strangways Springs, *Basedow 28*, 5.1920 (NSW); Lake Eyre, *Baldwin Spencer NSW 30691*, 9.1903 (NSW); between Old McDouall Peak & Twin Wells [c. 29° 50' S, 135° 00' E] *Basedow 61*, 4-5.1917 (NSW) Flinders Ranges: Farina c. 32 miles [c. 51 km] S. of Marree, *Briggs 4557*, 5.1972 (NSW); Mt Lyndhurst, *Koch 73*, 8.1898 (BRI), *Agric. Bureau S. Australia NSW 30674*, 1.1897 (NSW); tributary of Hookina R., 3 km NW. of Arkaba, 20 km NNE. of Hawker, *Ollerenshaw & Sikkes AS 695*, 9.1973 (NSW); Arkaba Ck, 10 miles [16 km] NNE. of Hawker, *Thompson NSW 117280*, 5.1969 (NSW). Eastern Region: c. 12 miles [c. 19 km] SSW. of "Moolawatana" homestead, 30° 00' S, 139° 35' E, *Briggs 4654*, 5.1972 (NSW). Eyre Peninsula: Mambray Ck road crossing, *Symon 4061*, 9.1966 (CANB). Northern Lofty: Germein Pass, *Burbidge & Gray 4081*, 9.1955 (CANB); towards Port Pirie from Crystal Brook, *Phillips 39*, 9.1973 (NSW). Southern Lofty: Morialta near Adelaide, *Cheal NSW 30682*, 8.1924 (NSW); Waterfall Gully, *Menzel NSW 30684*, 9.1896 (NSW); Brighton (sea coast), *Menzel 3.1897* (BRI), *Menzel NSW 30692*, 5.1897 (NSW).

NORTHERN TERRITORY: Darwin & Gulf District: Settlement Creek, *Brass 328*, 5.1923 (BRI)*; Gulf of Carpentaria, *Watson NSW 30672*, 10.1918 (NSW). Central Australia: 14.5 km E. of "Tarlton Downs" homestead, 22° 40' S, 136° 55' E, *Macanochie 372*, 7.1967 (BRI); 35.3 miles [c. 57 km] E. of "Elkedra" homestead, *Chippendale NT 3139*, 10.1956 (NSW); 19 miles [31 km] NE. of "Ooratippra", *Swinbourne 578*, 11.1962 (NSW); 22 miles [35 km] NE. of "Ooratippra", *Perry 3447*, 3.1953 (BRI, CANB); 7.5 miles [12.5 km] W. of 13 Bore, Sandover Stock Route, *Chippendale NT 2524*, 8.1956 (NSW); Yuendumu, *McKee 8600*, 2.1960 (BRI); near "Luey Creek" homestead, *Lazarides 5899*, 9.1956 (NSW, BRI); 2.5 miles [4 km] SW. of "Luey Creek" homestead, *Chippendale NT 3521*, 7.1957 (NSW, BRI); Old Tank crossing, "Marqua", *Chippendale NT 1787*, 10.1955 (NSW, BRI); Harry Creek . . . N. of Alice Springs, *Nelson 654*, 3.1963 (NSW), *Nelson 1497*, 5.1967 (NSW), *Swinbourne 441*, 9.1962 (NSW, CANB); 35 miles [56 km] from Plenty R. towards Harts Ra., *Gittins 1986*, 9.1969 (NSW, BRI); 23.4 miles [c. 38 km] E. of Harts Range Depot, *Chippendale NT 3169*, 10.1956 (NSW, CANB); Standley Chasm, 35 miles [56 km] W. of Alice Springs, *Chippendale NT 528*, 11.1954 (NSW, BRI); Standley Chasm, *Perry 5385*, 9.1955 (NSW, BRI, CANB); Stuart Highway c. 35 km SSW. of Alice Springs, *Lee 356*, 9.1978 (NSW); Telegraph Terrace, Alice Springs (cult., seed ex Harry Ck), *Nelson 1388*, 5.1965 (BRI); Alice Springs (cult., seed ex Harry Ck), *Swinbourne NT 11693*, 5.1965 (BRI); Heavitree Ra., 23° 40' S, 133° 25' E, *Gittins 2013*, 9.1969 (BRI, NSW); Serpentine Gorge, Macdonnell Ra., *Vickery NSW 117303*, 8.1960 (NSW); 2 miles [3 km] W. of Finke R. crossing near Hermannsburg, *Vasek 680914-44*, 9.1968 (CANB); Palm Valley, *Chippendale NT 2694*, 8.1956 (NSW); 7.8 miles [c. 13 km] SE. of Bottom Bore, Hale R., *Chippendale NT 4932*, 9.1958 (NSW, BRI); Docker Creek, *Chippendale NT 4566*, 6.1958 (NSW, BRI); Hull R., Petermann Ra., *Macanochie 1847*, 8.1973 (BRI); Ayers Rock, *Chippendale NT 673*, 11.1954 (NSW); "Mulga Park", 50 miles [80 km] N. of "Ernabella", *Turvey NSW 117279*, 6.1967 (NSW); "Mulga Park", 25° 57' S, 131° 50' E, *Henshall 172*, 4.1974 (NSW)*; Mann Ra., 30 miles [48 km] ENE. of Mt Davies Camp, *Dunlop 2004*, 10.1970 (NSW).

2. *P. patens* Lindl. in Mitchell, Three Exped. 2: 9 (1838). F. Mueller, *Fragm.* 3: 45 (1862). HOLOTYPE: Interior of New Holland, *Major Mitchell's Expedition 1836*, 19 March No. 2 (CGE !, photo NT !). ISOTYPE, K ! (Herb. Hook., photo. CANB !); from Mitchell's text, this Type was collected at c. 33° 20' S, 148° 40' E, i.e. c. 35 km W. of Orange [New South Wales—Central Western Slopes].



Figs 2, 3. Fig. 2. *P. australasica*: 2a. stylized sketch to indicate erect habit and long, interrupted inflorescences, $\times \frac{1}{3}$. 2b. bud showing calyx with nearly equal teeth, $\times 7$. Fig. 3. *P. patens* 3a. stylized sketch to indicate prostrate habit and short, continuous inflorescences, $\times \frac{1}{3}$. 3b. bud showing calyx with longer lowest lobe, $\times 7$.

P. eriantha Benth. in Mitchell, Trop. Australia: 131 (1848); F. Mueller, Fragm. 3: 45 (1862) as syn. of *P. patens*; Benth. Fl. Austral. 2: 192 (1864); F. M. Bailey, Queensland Fl. 2: 382 (1900)—inclusive of *P. pallida*; Beard, Descr. Cat. West Austral. Pl: 71 (1965). HOLOTYPE: 1846. 90 Ap. 16.46 [No. 90, 16 April 1846], a creeping plant; Balonne [as "Baloon"] R., Sub-Tropical New Holland. *Lieut.-Col. Sir T. L. Mitchell* (K). ISOTYPE, NSW! From Mitchell's text, this collection was made near St George [Queensland-Maranoa].

P. discolor Domin, Biblioth. Bot. 22(89²): 738 (1925). ISOSYNTYPE: 96. *J. Drummond*, S. W. Australia 1850 (K, n.v., photo. CANB!); cited as 'Sudwest Australien: Drummond 1850 No. 96'. ? ISOSYNTYPE (with attached field label "96"): *Psoralea eriantha* 5th. coll., "W. Australia 1849" (in ink on a pencilled label), Drummond no. 96 (NSW!).

[The name *P. patens* was misapplied by most Australian authors to *P. australasica* q.v., though their descriptions indicate that the two taxa treated here as species were not so distinguished by them, following Mueller in Fragm. 3: 45 (1862)].

[*P. eriantha* sensu auct. non Benth.: Tate (1890), and Domin (1925), misapplied this name to *P. pallida* q.v.]

Diagnostic characters as given in the Key and Table. *P. patens* shows a few general trends; there is also one quite common atypical form which is fairly uniform over a wide area of inland Australia.

Flowers tend to increase in size northwards in the main area of occurrence, i.e. in eastern Australia, and the calyx character (unequal teeth with the lowest longer than the others) becomes more marked in the longer flowers; there is perhaps a similar trend in the density of the inflorescence, also increasing northwards—the Holotype falls into the lower part of all these trends, and there is an overlap in dimensions with both *P. australasica* and *P. pallida*. An erect plant occurs rarely, with all other characters typical; since prostrateness is dominant this is to be expected (see p. 130). There is also an erratic occurrence of plants with smaller, to almost capitate, inflorescences; a number of them occur in Western Australia, where one was distinguished as *P. discolor* Domin. Fig. 3.

Several collections from inland areas are linked by one unusual feature. The plants of this atypical form have tomentose leaves giving them a greyish green appearance. Other characters are typical except that most of these specimens tend to have the shortest inflorescences in the species including some like those described for *P. discolor*. That "species", however, has leaves "altogether glabrous". Distribution maps for *P. patens* and *P. pallida* show that these atypical inland plants are virtually the only representatives of *P. patens* which occur sympatrically with *P. pallida*, and it is difficult not to infer interbreeding. Some, but not all, of them show broader leaflets with repand-denticulate margins also seen in *P. pallida*.

DISTRIBUTION (see fig. 4): the typical form occurs in all States except Tasmania, from the Type locality in the Central Western Slopes of New South Wales northwards into Queensland, where it is common in the Warrego and Maranoa Districts, and southwards into western Victoria. An atypical form with $\pm$ densely tomentose leaflets occurs in a broad NW-SE band from central Northern Territory across the Simpson Desert to western New South Wales, and there appear to be scattered occurrences of the typical form in South Australia, Western Australia and the Northern Territory (in the last two States the material examined probably does not show the distribution fully). The species is usually found on sandy soils but field botanists have reported that its sites tend to be favourable as to water content.

SPECIMENS EXAMINED (* indicates atypical form): QUEENSLAND: Burke: 10 miles [16 km] SE. of Doomadgee on road to Burketown, *Ollerenshaw* PO 1352 & *Kratzing*, 7.1974 (BR1). Gregory North: Georgina R., *Henry* 1889 (MEL). South Kennedy: Upper Belyando [R.], *Donaldson* 1890 (MEL); "Mentmore", Alpha, *McLaughlin*, 1.1955 (BR1). Leichhardt: 25 miles [40 km] SW. of Rolleston on "Springwood", *Wetherell* 116, 12.1964 (BR1). Warrego: Burenda [Downs], *Bailey* [as FMB] (BR1); "Akaray", Augathella, *Cull* 12.1961 (BR1); "Gowrie", Charleville, *Kerridge* "specimen 3", 4.1958 (CANB), *Hart* 3.1956 (BR1), do., c. 12 miles [c. 19 km] NE. of Charleville, *Everist* 5909, 11.1957 (CANB, BR1, NSW), do. 22 km NNE. of Charleville, *Smith* 06111, 11.1954 (BR1); Charleville, *Clemens* 10.1945 (BR1); Charleville, bed of Warrego R., *Michael* 3036, 5.1947 (BR1). Maranoa: "Lorne Downs" c. 70 miles [112 km] NW. of Mungalalla, *Martin* 1.1964 (BR1); between the Barcoo and the Roma, *Birch* 1871 (MEL); Roma, *Scortechini* (BR1); Maranoa, scr. *Mueller* 1885 (MEL); St. George, *Winn* 5.1894 (BR1); Thallon, *Cameron* 4.1940 (BR1). Darling Downs: near the Condamine River S. of Chinchilla, *Everist* s.u. 10.1951 (BR1); "Junabee", *Swann* 12.1972 (BR1).

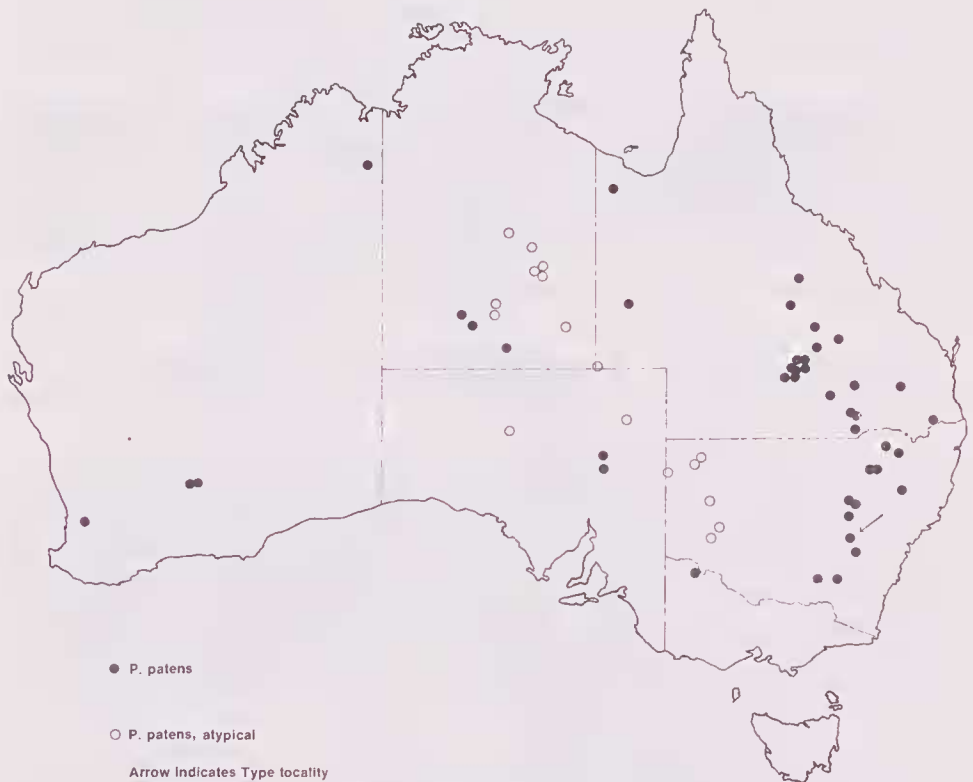


Fig. 4. Distribution of *P. patens*.

NEW SOUTH WALES: North Western Slopes: Crooble, *Williams* 15, 10.1951 (CANB); Warialda, *Rupp* NSW 30819, 1.1907 (NSW); Narrabri, *Breakwell* NSW 30670, 10.1912, NSW 30671, 11.1912 (NSW); Howes Sheep Station, *Leichhardt* 4.1843—assuming vicinity Tamworth (NSW). Central Western Slopes: Gilgandra, *Cabbage* 1130, 10.1904 (NSW); Dubbo, *Boorman* NSW 30666, 5.1900 (NSW); Wellington, *Bünerlen* 2855, 1.1903, an erect plant (NSW); Cowra, *Tickner* NSW 117289, 5.1965 (NSW). South Western Slopes: Wagga Experiment Farm, *Ross* NSW 30668, 3.1920 (NSW); Gundagai, *Herd Master*, *Dept. Agric.* NSW 30667, 3.1918 (NSW). Far Western Plains: Cobham Lake, *Cunningham & Milthorpe* 1066, 9.1973 (NSW)*; roadside between Cobham Lake and the Salt Lake, *Lee* 255, 9.1971 (NSW)*; S. Australia border fence N. of "Brougham's Gate" 30° 30' S, 141° 10' E, *Lee* 230, 9.1971 (NSW)*; Old Woolshed Bore, 11 km SW. of "Moalie Park" towards Salisbury Downs, 29° 50' S, 142° 47' E, *Pickard* 3042, 10.1976 (NSW)*; Boolaboolka Lake, *Milthorpe & Cunningham* 2674, 8.1974 (NSW)*; 8 miles [13 km] W. of Pooncarie, Darling R., *Keast* 7, 9.1962 (NSW)*.

VICTORIA: Region F: Kooloonong, c. 45 miles [c. 73 km] NW. of Swan Hill, *Macfarlane* 11.1961 (NSW)*.

SOUTH AUSTRALIA: Lake Eyre Basin: First Dunes of the Simpson Desert (presumably on Birdsville Track), *Symon* 9391, 9.1974 (NSW)*; Central South Australia, *Hillier* 120, . . . 1906 (BRI)*; Lake Eyre, *Hill* 429, 11.1955 (MEL); Hergot's [Hergott] Spring [Bore] [Marree], *Molineux* 1895 (MEL).

WESTERN AUSTRALIA: South-Western Interzone-Coolgardie: Coolgardie, *Webster* NSW 30556, 1900 (NSW).

NORTHERN TERRITORY: Central Australia: "Singleton", 240 miles [386 km] N. of Alice Springs, *Everist* 4242, 1.1950 (BRI)*; Burrabellly Waterhole, Frew R., 20° 52' S, 135° 12' E, *Dunlap* 2503, 2.1972 (BRI)*; 20 miles [32 km] NW. of "Ooratippra" Station, *Lazarides* 6230, 4.1957 (BRI, NSW, MEL)*; 44.9 miles [c. 71 km] E. of "Ammaroo" homestead, *Chippendale* NT 3798, 9.1957 (NSW, BRI)*; 7.5 miles [c. 12 km] W. of 13 Bore, Sandover Stock Route, *Chippendale* NT 2525, 8.1956 (NSW, BRI, MEL)*; 16-mile Ck., 18 miles [29 km] N. of Alice Springs, *Nelson* 661, 3.1963 (NSW)*; 19 miles [30 km] S. of Alice Springs, *Nelson* 463, 8.1962

(BRI)*; c. 3 miles [c. 5 km] N. of Gosses Bluff, *Chippendale NT 4152*, 4.1958 (BRI, MEL); 5 km S. of Hermannsburg, *Lee 367*, 9.1978 (NSW); Finke R., *Kempe 373*, 1881 (MEL); Northwestern Simpson Desert, 24° 09' S, 136° 04' E, *Henry 976*, 9.1973 (NSW)*; Poppel Corner, 26° S, 138° E, *Boylard 286*, 9.1966 (BRI)*.

3. *P. pallida* N. T. Burb., *Telopea* 2 (1): 127 (1980). HOLOTYPE: app. 22 miles [c. 35] south of Alice Springs, on railway line road, *N. T. Burbidge & M. Gray 4379*, 29.9.1955 (CANB !). ISOTYPES: CANB !, NSW (CANB 241933 !) and (to be sent to) K !, PERTH!

[*Psoralea eriantha* sensu auct., non Benth.: Tate, *Hanb. Fl. Extratrop. South Australia*: 69 (1980); Domin, *Biblioth. Bot.* 22 (89²): 738 (1925)].

[“*Psoralea* sp. aff. *P. eriantha*”, “*P. sp. aff. P. patens* sens. lat.” and other similar *nominanda* have been applied to this species.]

Diagnostic characters as given in the Key and Table. *P. pallida* shows little variation beyond slight differences in flower and inflorescence dimensions, density of the white tomentum and spacing of flowers in the inflorescence. Rarely, but perhaps more often than is apparent, plants with other characters of *P. pallida* may have erect stems, but probably only weakly so. Allowance must be made for inaccurate use of terms used for habit, “ascending” and “erect” being interchanged, as well as “prostrate” and “decumbent”. Most plants appear to have stems at first ascending (at c. 45°), then decumbent (prostrate with ascending tips) when their proximal parts drop to the ground. Another occasional variation not infrequent in *P. pallida* and seen only in an atypical form of *P. patens* among taxa of this complex, is shown by the leaflets. They are broader, more rounded, and more repand-denticulate on their margins. Fig. 5.

A few specimens from Central Queensland show flowers and inflorescences of *P. pallida* but leaves and habit of *P. australasica*, and cannot be unequivocally determined. They are cited and mapped with *P. australasica* above. Some reversal of this situation is seen in two specimens which are closer to *P. pallida* but show some characters of *P. australasica*. They are cited and mapped with *P. pallida* as atypical (*Perry 4076*, *Must 322*).

DISTRIBUTION (see fig. 6): common on sand dunes in the Simpson Desert and in all the surrounding States, reaching into the far southwest of New South Wales and across the Murray River into northwestern Victoria.

SPECIMENS EXAMINED (* indicates atypical form): QUEENSLAND: Burke: 33 miles [53 km] E. of Cloncurry township, *Perry 4076*, 9.1953 (NSW, BRI)*—very long inflorescences and in heavy grey soil. Gregory North: sand dune 54 km W. of “Glenormiston”, *Purdie 1077*, 9.1977 (BRI); “Glenormiston”, home paddock, *Colliver 38*, 8.1949 (BRI); Mulligan R., *Clarke NSW 30647*, 2.1904 (NSW); 25 miles [40 km] ESE [? SSE] of Bedourie, “Cluny” homestead, 24° 31' S, 139° 36' E, *Silcock S276*, 6.1970 (BRI); “Currawilla”, 5-mile paddock, *Everist 3985*, 6.1949 (BRI). Gregory South: 38 miles [61 km] W. of Windorah, *Boylard 155*, 9.1966 (BRI); 10 miles [16 km] from Windorah towards “Currawilla” Station, *Gittins 1939*, 8.1969 (NSW); “South Galway”, 45 miles [72 km] SW. of Windorah, *Everist 4038*, 6.1949 (BRI); Birdsville, *Everist & Smith 88*, 1.1937 (BRI); “Thylungra, c. 75 miles [121 km] NW of Quilpie, *Everist 5785A*, 10.1955 (BRI); 171.2 km NW. of “Noecundra”, 26° 58' S, 141° 06' E, *Boylard 3109*, 7.1971 (BRI). Warrego: 23 miles [37 km] WNW. of Thargomindah, *Pedley 2473*, 9.1967 (BRI).

NEW SOUTH WALES: North Far Western Plains: 3.4 km W. of Fortville, Queensland–New South Wales border, 29° 00' S, 141° 09' E, *Pickard 3175*, 11.1976 (NSW); Queensland border between Warri Gate [House] and Fort Grey, *Richley 1506*, 12.1974 (NSW); Sturt Natl. Park, 29° 15' S, 141° 45' E, *Mulham W920*, 10.1976 (NSW); Solly Tank, near Fort Grey, *Dorman NSW 117296*, 9.1967 (NSW); “Yandama” (W. of Milparinka), *Richley 1246*, 10.1973 (NSW); c. 2 miles [c. 3 km] S. from Cobham Lake, *Lee 258*, 9.1971 (NSW); Paldrumatta Bore, *Corbett NSW 30652*, 10.1901 (NSW); Cobham sandhills, *Morris 788*, 10.1921 (NSW, BRI); Cobham mailbox, *Cunningham & Milthorpe 1044*, 9.1973 (NSW); “Cobham” 30° 18' S, 142° 07' E, *Lawrie 1558*, 7.1974 (NSW); “Teiltla” Station, 116 km NNW of Broken Hill, 30° 50' S, 141° 14' E, *Lee 217*, 9.1971 (NSW); Tilpa, *Turner NSW 30656*, 4.1916 (NSW); between Tilpa & Barnato, *McReddie NSW 117295*, 5.1967 (NSW); “Nelyambo”, 20 miles [32 km] NE. of Wilcannia . . . *Werner (388)*, 11.1969 (NSW). South Far Western Plains: “Wirryilka” c. 70 miles [c. 113 km] SE. of Broken Hill, *Milthorpe 679*, 3.1972 (NSW); “Kinchega” Natl. Park, Menindee, *Ryan & Everly NSW 130141*, 6.1969 (NSW); . . . 4 km E. of Menindee, *Sikkis 1273*, 9.1973 (NSW); Menindee, *Johnson 709*, 9.1946 (NSW), *Richley 1336*, 10.1973 (NSW); “Willottia” Station, via

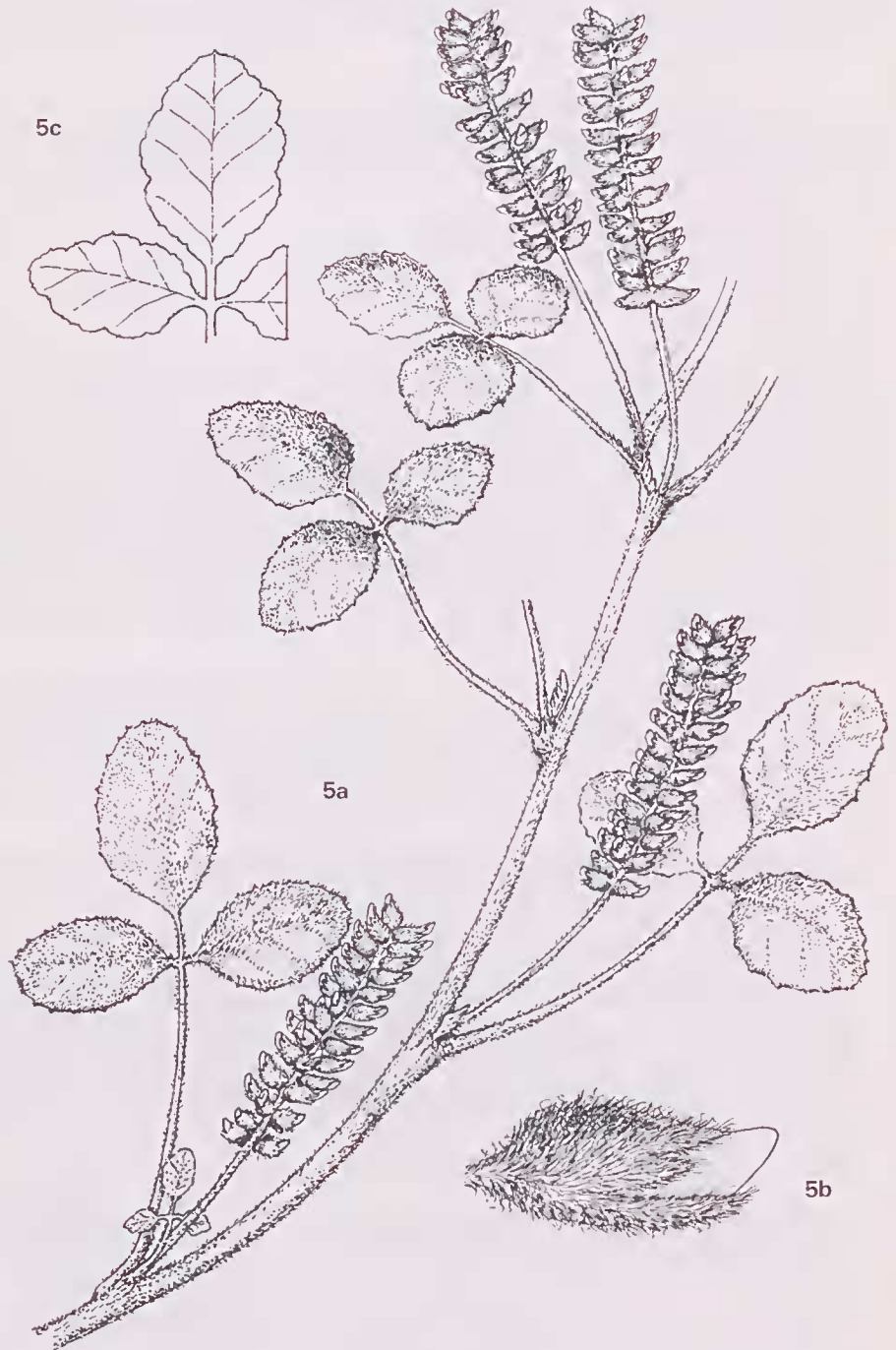


Fig. 5. *P. pallida*: 5a. stylized sketch to indicate ascending habit and continuous inflorescences, $\times \frac{1}{3}$. 5b. bud showing calyx with long lowest lobe, $\times 5$. 5c. leaf with repand-denticulate margins, $\times \frac{1}{3}$.

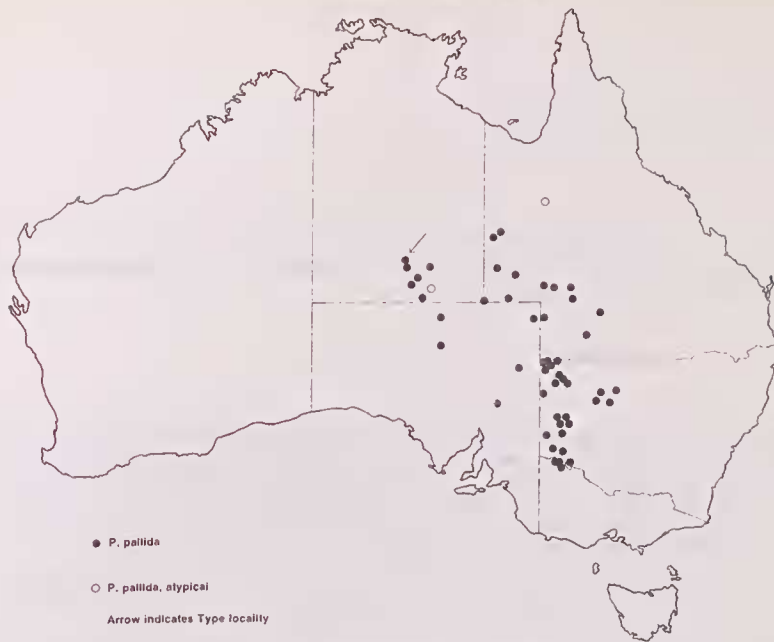


Fig. 6. Distribution of *P. pallida*.

Menindee, *Cantello NSW 117297*, 1.1956 (NSW); 79 miles [127 km] S. of Broken Hill, *Leigh W54*, 10.1966 (NSW); "Garston" Station via Wentworth, *Cullinan NSW 117294*, 5.1963 (NSW); Wentworth-Poonerarie, *Constable NSW 4567*, 10.1947 (NSW); between Euston & Gol Gol, *Vickery NSW 30655*, 10.1949 (NSW).

VICTORIA: **Region A:** Hattah Lakes National Park, *Beaughole 39184* & *Willis*, 10.1960 (MEL), *Beaughole 1026*, 10.1948 (MEL), *Beaughole 39183*, 10.1960 (MEL); near Hattah Lakes Natl. Park, *Cunningham & Milthorpe 5622*, 12.1978 (NSW); Mildura, *Willis*, 5.1937 (MEL); Kings Billabong, between Mildura and Red Cliffs, *Heushall 11.1965* (MEL). **Region G:** Woorinen, c. 6–7 miles [c. 10–11 km] WNW. of Swan Hill, per *Irwin*, 6.1969 (MEL).

SOUTH AUSTRALIA: **Lake Eyre Basin:** Brady's Waterhole near "Cordillo Downs", *Basedow 60*, 10.1919 (NSW); Strzelecki Track, *Milthorpe & Cunningham 3030*, 10.1974 (NSW); Mt Kingston [? Old Bore], *Macd. Stuart* (MEL); . . . 38 miles [61 km] E. of Dalhousie Springs, *Lothian 1660*, 8.1963 (MEL); Blinman, per *Tepper 1890* 'No. 1439' (MEL).

NORTHERN TERRITORY: **Central Australia:** 19.6 miles [c. 32 km] S. of Alice Springs, *Chippendale NT 9613*, 10.1962 (CANB); c. 65 km S. of Alice Springs, *Lee 372*, 10.1978 (NSW); Northwestern Simpson Desert, *Henry 935*, 9.1973 (NSW); 2 miles [3 km] N. of Bundooma Siding, *Swinbourne 417*, 8.1962 (NSW); 6.5 miles [10.4 km] N. of Horseshoe Bend, *Chippendale NT 3913*, 10.1957 (NSW); Charlotte Waters, *Byrne 1887* (MEL), *Schwartz 1889* (MEL); 17 miles [23 km] NW. of "Andado" homestead, *Must 322*, 8.1968 (BRI)*—leaves very sparsely pubescent; Poeppel Corner 26° S, 138° E, *Boyland 278*, 9.1966 (BRI).

ACKNOWLEDGEMENTS

Acknowledgement is made of loan, or facilities for examination, of specimens by the following herbaria: BRI (loan), NT, MEL, CANB. Dr Barbara Briggs, Dr L. A. S. Johnson and Mrs Joy Thompson gave assistance in preparation of my manuscript. Mr J. R. Maconochie provided transport for useful observation of living populations in Central Australia. Mr I. de Lacy conferred over determinations, and recounted field observations, while on a visit to Sydney. A grant from the Australian Biological Resources Study enabled me to examine the Holotype of *P. patens* at CGE in 1974. The illustrations are the work of R. Roden, who also prepared the maps for reproduction.